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EDITORIAL: LINKING SHORT-TERM GEOMORPHIC PROCESSES TO LANDSCAPE EVOLUTION

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This special issue arises out of a symposium organized by the British Geomorphological Research Group (BGRG), which took place in Glasgow on 4 January 1996, during the annual conference of the newly merged Royal Geographical Society/Institute of British Geographers (RGS/IBG). As befits a symposium forming part of the first meeting of the new parent body, we took the opportunity to look ahead and tackle one of the most pressing and long-standing problems facing geomorphology: how best does one link small-scale process studies, carried out over time-scales of weeks or a few years, to the larger-scale components of the landscape that have evolved over thousands to millions of years? If geomorphology is to say something useful about the links between short-term processes and large-scale forms, then this is a nut that must be cracked.

As the papers in this issue show, this debate, involving a search for the integration of what some have described as the functional and historical approaches to explanation, has been a recurrent theme in geomorphology during the past century. Over the past several decades the functional approach, with a research strategy based on the experimental sciences emphasizing process measurement, laboratory studies, and at least an implied reductionism, has thrived. By contrast, the previously dominant historical approach, which traditionally has relied much on the interpretation of landscape elements in its reconstruction of a sequence of landscape change through time, has been less popular. Indeed, its lack of prominence has hindered progress in the earth and environmental sciences on a broader front, as has been illustrated in the controversy about the sensitivity of the East Antarctic Ice Sheet to climate change (Sugden, 1996). Few studies have attempted to bridge the gap between surface processes and long-term landscape development, the process–response models of Ahnert (1987) being a notable exception.

There are several reasons for taking a fresh look at the relationship between studies of short-term processes and landscape evolution. Appreciation of non-linear behaviour in environmental systems has demanded a reappraisal of the role of prediction, introduced a new awareness of levels of uncertainty in science, and encouraged new types of question to be asked. After a delay of several years, recognition of the potential of new techniques, such as the application of cosmogenic isotopes and thermochronology to the estimation of denudation rates, has opened up the possibility of quantifying rates of landscape change on time-scales of up to *c*.100 million years or more (Summerfield, 1996). Finally, there has been great interest amongst the geophysics community in the potential of geomorphological studies to provide insights into tectonic mechanisms; in addition, there are now geophysical models to underpin studies of long-term landscape evolution. This is some of the background which stimulated the symposium and which is reflected in the papers from an interdisciplinary and international mix of contributors.

A number of papers explore new developments and their significance for investigations of landscape evolution. These include: a novel demonstration of the way in which cosmogenic exposure age dating may be used to study the rate of knickpoint propagation, the key to the long-term evolution of fluvial landscapes (Seidl); the value of simulation modelling as a means of exploring the theory underpinning the evolution of valley networks in the real world (Howard); an insight into the value of sedimentary basins as a means of determining sediment flux over long time periods (Leeder); and a quantitative assessment of the uncertainties involved in the estimation of denudation rates from thermochronology (Brown and Summerfield). Other papers use a wide

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variety of expertise in different fields of geomorphology to point to the methodological problems involved when linking small-scale studies to general theory. Perhaps non-linear thinking raises new questions about the interdependence of processes at different scales (Lane and Richards); perhaps we should focus on organizational structures rather than processes themselves (Spedding); perhaps simulation modelling should be regarded more as interpretative art than objective science and used as such (Kerr)? Martin and Church show the limitations of assuming a linear relationship between debris transport and slope in landscape modelling, while the difficulty of relating solution processes to their spatial context is explored by Trudgill and Wise; Evans draws attention to the importance of identifying the representativeness of any case study. Finally, there are three investigations which attempt to quantify long-term rates of change and their link to the main geomorphological process responsible. We learn of the great age of the surface of the Scandinavian Shield and the limited role of glacial erosion in shaping its topography (Lidmar-Bergström); the use of uranium-series speleotherm dating in establishing rates of lowering during glacial cycles in Scotland (Hebdon *et al*.); and the long-term effects of glaciation of a mountain range experiencing rapid crustal uplift in New Zealand (Kirkbride and Matthews).

We hope that the mix of subject matter across a wide range of geomorphology, the contrasts in theoretical and empirical approaches, the involvement of different disciplinary viewpoints, and the inclusion of papers representing five different national traditions will prove stimulating. There is obvious excitement about the potential for a geomorphology which effectively embraces and links short-term process studies with long-term landscape evolution.

It remains to thank warmly all those who contributed to the symposium, those who contributed to the papers, and the many referees who assisted in the production of this volume. We would also like to thank the RGS/IBG and the BGRG for their support of international contributors.

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